

EC441: Lab 3

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4.3 Web Server Program

Figure 1: The HTTP GET message for the nonexistent `hhello_world.html` file

3 0..	172.16.70.135	128.197.52.142	TCP	54 34676 → 47231 [ACK] Seq=1 Ack=1 Win=29200 Len=0
4 0..	172.16.70.135	128.197.52.142	HTTP	378 GET /hello_world.html HTTP/1.1
5 0..	128.197.52.142	172.16.70.135	TCP	60 47231 → 34676 [ACK] Seq=1 Ack=325 Win=64240 Len=0
6 0..	128.197.52.142	172.16.70.135	HTTP	86 HTTP/1.1 404 File Not Found
7 0..	172.16.70.135	128.197.52.142	TCP	54 34676 → 47231 [FIN, ACK] Seq=325 Ack=34 Win=29200 Len=0
8 0..	128.197.52.142	172.16.70.135	TCP	60 47231 → 34676 [ACK] Seq=34 Ack=326 Win=64239 Len=0
9 0..	172.16.70.135	128.197.52.142	TCP	74 34678 → 47231 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=426622 TSecr=0 W...
10 0..	128.197.52.142	172.16.70.135	TCP	60 47231 → 34678 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460
11 0..	172.16.70.135	128.197.52.142	TCP	54 34678 → 47231 [ACK] Seq=1 Ack=1 Win=29200 Len=0
12 0..	172.16.70.135	128.197.52.142	HTTP	342 GET /favicon.ico HTTP/1.1
13 0..	128.197.52.142	172.16.70.135	TCP	60 47231 → 34678 [ACK] Seq=1 Ack=289 Win=64240 Len=0
14 0..	128.197.52.142	172.16.70.135	TCP	70 [TCP segment of a reassembled PDU]
15 0..	172.16.70.135	128.197.52.142	TCP	54 34678 → 47231 [ACK] Seq=289 Ack=17 Win=29200 Len=0
16 0..	172.16.70.135	128.197.52.142	TCP	74 34678 → 47231 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=426622 TSecr=0 W...
▶ Frame 4: 378 bytes on wire (3024 bits), 378 bytes captured (3024 bits) on interface 0				
▶ Ethernet II, Src: Vmware_cb:71:3f (00:0c:29:cb:71:3f), Dst: Vmware_e2:42:4f (00:50:56:e2:42:4f)				
▶ Internet Protocol Version 4, Src: 172.16.70.135, Dst: 128.197.52.142				
▶ Transmission Control Protocol, Src Port: 34676 (34676), Dst Port: 47231 (47231), Seq: 1, Ack: 1, Len: 324				
▼ Hypertext Transfer Protocol				
▶ GET /hello_world.html HTTP/1.1\r\n				
Host: 128.197.52.142:47231\r\n				
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:43.0) Gecko/20100101 Firefox/43.0 Iceweasel/43.0.4\r\n				
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8\r\n				
Accept-Language: en-US,en;q=0.5\r\n				
Accept-Encoding: gzip, deflate\r\n				
Connection: keep-alive\r\n				
\r\n				
[Full request URI: http://128.197.52.142:47231/hello_world.html]				
[HTTP request 1/1]				
[Response in frame: 6]				

Figure 2: The HTTP GET response 404 message for the nonexistent `hhello_world.html` file

5 0..	128.197.52.142	172.16.70.135	TCP	60 47231 → 34676 [ACK] Seq=1 Ack=325 Win=64240 Len=0
6 0..	128.197.52.142	172.16.70.135	HTTP	86 HTTP/1.1 404 File Not Found
7 0..	172.16.70.135	128.197.52.142	TCP	54 34678 → 47231 [FIN, ACK] Seq=325 Ack=34 Win=29200 Len=0
8 0..	128.197.52.142	172.16.70.135	TCP	60 47231 → 34676 [ACK] Seq=34 Ack=326 Win=64239 Len=0
9 0..	172.16.70.135	128.197.52.142	TCP	74 34678 → 47231 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=426622 TSecr=0 W...
10 0..	128.197.52.142	172.16.70.135	TCP	60 47231 → 34678 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460
11 0..	172.16.70.135	128.197.52.142	TCP	54 34678 → 47231 [ACK] Seq=1 Ack=1 Win=29200 Len=0
12 0..	172.16.70.135	128.197.52.142	HTTP	342 GET /favicon.ico HTTP/1.1
13 0..	128.197.52.142	172.16.70.135	TCP	60 47231 → 34678 [ACK] Seq=1 Ack=289 Win=64240 Len=0
14 0..	128.197.52.142	172.16.70.135	TCP	70 [TCP segment of a reassembled PDU]
15 0..	172.16.70.135	128.197.52.142	TCP	54 34678 → 47231 [ACK] Seq=289 Ack=17 Win=29200 Len=0
16 0..	172.16.70.135	128.197.52.142	TCP	74 34678 → 47231 [SYN] Seq=0 Win=29200 Len=0 MSS=1460 SACK_PERM=1 TSval=426622 TSecr=0 W...
▶ Frame 6: 86 bytes on wire (688 bits), 86 bytes captured (688 bits) on interface 0				
▶ Ethernet II, Src: Vmware_e2:42:4f (00:50:56:e2:42:4f), Dst: Vmware_cb:71:3f (00:0c:29:cb:71:3f)				
▶ Internet Protocol Version 4, Src: 128.197.52.142, Dst: 172.16.70.135				
▶ Transmission Control Protocol, Src Port: 47231 (47231), Dst Port: 34676 (34676), Seq: 1, Ack: 325, Len: 32				
▼ Hypertext Transfer Protocol				
▶ HTTP/1.1 404 File Not Found\r\n				
\r\n				
[HTTP response 1/1]				
[Time since request: 0.000856992 seconds]				
[Request in frame: 4]				
▶ Data (2 bytes)				

Figure 3: The HTTP GET message for the hello_world.html file

5 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=1 Ack=1 Win=29200 Len=0
6 0..	172.16.70.135	128.197.52.142	HTTP	377 GET /hello_world.html HTTP/1.1
7 0..	128.197.52.142	172.16.70.135	TCP	60 47321 → 40778 [ACK] Seq=1 Ack=324 Win=64240 Len=0
8 0..	128.197.52.142	172.16.70.135	TCP	70 [TCP segment of a reassembled PDU]
9 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=324 Ack=17 Win=29200 Len=0
10 0..	128.197.52.142	172.16.70.135	TCP	89 [TCP segment of a reassembled PDU]
11 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=324 Ack=52 Win=29200 Len=0
12 0..	128.197.52.142	172.16.70.135	TCP	139 [TCP segment of a reassembled PDU]
13 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=324 Ack=137 Win=29200 Len=0
14 0..	128.197.52.142	172.16.70.135	HTTP	60 HTTP/1.1 200 OK
15 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=324 Ack=141 Win=29200 Len=0
16 0..	128.197.52.142	172.16.70.135	TCP	60 47321 → 40778 [ACK] Seq=141 Ack=324 Win=64240 Len=0
▶ Frame 6: 377 bytes on wire (3016 bits), 377 bytes captured (3016 bits) on interface 0				
▶ Ethernet II, Src: Vmware_cb:71:3f (00:0c:29:cb:71:3f), Dst: Vmware_e2:42:4f (00:50:56:e2:42:4f)				
▶ Internet Protocol Version 4, Src: 172.16.70.135, Dst: 128.197.52.142				
▶ Transmission Control Protocol, Src Port: 40778 (40778), Dst Port: 47321 (47321), Seq: 1, Ack: 1, Len: 323				
▼ Hypertext Transfer Protocol				
▶ GET /hello_world.html HTTP/1.1\r\n				
Host: 128.197.52.142:47321\r\n				
User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:43.0) Gecko/20100101 Firefox/43.0 Iceweasel/43.0.4\r\n				
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8\r\n				
Accept-Language: en-US,en;q=0.5\r\n				
Accept-Encoding: gzip, deflate\r\n				
Connection: keep-alive\r\n				
\r\n				
[Full request URI: http://128.197.52.142:47321/hello_world.html]				
[HTTP request 1/1]				
[Response in frame: 14]				

Figure 4: The HTTP GET response message for the hello_world.html file

5 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=1 Ack=1 Win=29200 Len=0
6 0..	172.16.70.135	128.197.52.142	HTTP	377 GET /hello_world.html HTTP/1.1
7 0..	128.197.52.142	172.16.70.135	TCP	60 47321 → 40778 [ACK] Seq=1 Ack=324 Win=64240 Len=0
8 0..	128.197.52.142	172.16.70.135	TCP	70 [TCP segment of a reassembled PDU]
9 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=324 Ack=17 Win=29200 Len=0
10 0..	128.197.52.142	172.16.70.135	TCP	89 [TCP segment of a reassembled PDU]
11 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=324 Ack=52 Win=29200 Len=0
12 0..	128.197.52.142	172.16.70.135	TCP	139 [TCP segment of a reassembled PDU]
13 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=324 Ack=137 Win=29200 Len=0
14 0..	128.197.52.142	172.16.70.135	HTTP	60 HTTP/1.1 200 OK
15 0..	172.16.70.135	128.197.52.142	TCP	54 40778 → 47321 [ACK] Seq=324 Ack=141 Win=29200 Len=0
16 0..	128.197.52.142	172.16.70.135	TCP	60 47321 → 40778 [ACK] Seq=141 Ack=324 Win=64240 Len=0
▶ Frame 14: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0				
▶ Ethernet II, Src: Vmware_e2:42:4f (00:50:56:e2:42:4f), Dst: Vmware_cb:71:3f (00:0c:29:cb:71:3f)				
▶ Internet Protocol Version 4, Src: 128.197.52.142, Dst: 172.16.70.135				
▶ Transmission Control Protocol, Src Port: 47321 (47321), Dst Port: 40778 (40778), Seq: 137, Ack: 324, Len: 4				
▶ [4 Reassembled TCP Segments (140 bytes): #8(16), #10(35), #12(85), #14(4)]				
▼ Hypertext Transfer Protocol				
▶ HTTP/1.1 200 OK\r\n				
Last-Modified: 2016-10-20 12:49:43\r\n				
[HTTP response 1/1]				
[Time since request: 0.005420230 seconds]				
[Request in frame: 6]				
▶ Data (89 bytes)				

4.4 Favicon Webserver

Figure 5: The HTTP GET message for the favicon.ico file

86	0...	172.16.70.135	128.197.52.142	TCP	54 55460 → 47221 [ACK] Seq=1 Ack=1 Win=29200 Len=0
87	0...	172.16.70.135	128.197.52.142	HTTP	412 GET /favicon.ico HTTP/1.1
88	0...	128.197.52.142	172.16.70.135	TCP	60 47221 → 55460 [ACK] Seq=1 Ack=359 Win=64240 Len=0
89	0...	128.197.52.142	172.16.70.135	TCP	1046 [TCP segment of a reassembled PDU]
90	0...	172.16.70.135	128.197.52.142	TCP	54 55460 → 47221 [ACK] Seq=359 Ack=993 Win=30752 Len=0
91	0...	128.197.52.142	172.16.70.135	TCP	87 [TCP segment of a reassembled PDU]
92	0...	172.16.70.135	128.197.52.142	TCP	54 55460 → 47221 [ACK] Seq=359 Ack=1026 Win=30752 Len=0
93	0...	128.197.52.142	172.16.70.135	TCP	71 [TCP segment of a reassembled PDU]
94	0...	172.16.70.135	128.197.52.142	TCP	54 55460 → 47221 [ACK] Seq=359 Ack=1043 Win=30752 Len=0
95	0...	128.197.52.142	172.16.70.135	TCP	103 [TCP segment of a reassembled PDU]
96	0...	172.16.70.135	128.197.52.142	TCP	54 55460 → 47221 [ACK] Seq=359 Ack=1092 Win=30752 Len=0
97	0...	128.197.52.142	172.16.70.135	TCP	87 [TCP segment of a reassembled PDU]

▶	Frame 87: 412 bytes on wire (3296 bits), 412 bytes captured (3296 bits) on interface 0
▶	Ethernet II, Src: Vmware_cb:71:3f (00:0c:29:cb:71:3f), Dst: Vmware_e2:42:4f (00:50:56:e2:42:4f)
▶	Internet Protocol Version 4, Src: 172.16.70.135, Dst: 128.197.52.142
▶	Transmission Control Protocol, Src Port: 55460 (55460), Dst Port: 47221 (47221), Seq: 1, Ack: 1, Len: 358
▼	Hypertext Transfer Protocol
▶	GET /favicon.ico HTTP/1.1\r\n
▶	Host: 128.197.52.142:47221\r\n
▶	User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:43.0) Gecko/20100101 Firefox/43.0 Iceweasel/43.0.4\r\n
▶	Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8\r\n
▶	Accept-Language: en-US,en;q=0.5\r\n
▶	Accept-Encoding: gzip, deflate\r\n
▶	Connection: keep-alive\r\n
▶	If-Modified-Since: 2016-10-20 13:13:30\r\n
▶	\r\n
▶	[Full request URI: http://128.197.52.142:47221/favicon.ico]
▶	[HTTP request 1/1]
▶	[Response in frame: 109]

Figure 6: The HTTP GET response message for the favicon.ico file

109	0...	128.197.52.142	172.16.70.135	HTTP	60 HTTP/1.1 200 OK
110	0...	172.16.70.135	128.197.52.142	TCP	54 55460 → 47221 [FIN, ACK] Seq=359 Ack=1208 Win=30752 Len=0
111	0...	128.197.52.142	172.16.70.135	TCP	60 47221 → 55460 [ACK] Seq=1208 Ack=360 Win=64239 Len=0

▶	Frame 109: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface 0
▶	Ethernet II, Src: Vmware_e2:42:4f (00:50:56:e2:42:4f), Dst: Vmware_cb:71:3f (00:0c:29:cb:71:3f)
▶	Internet Protocol Version 4, Src: 128.197.52.142, Dst: 172.16.70.135
▶	Transmission Control Protocol, Src Port: 47221 (47221), Dst Port: 55460 (55460), Seq: 1202, Ack: 359, Len: 5
▶	[11 Reassembled TCP Segments (1206 bytes): #89(92), #91(33), #93(17), #95(49), #97(20), #99(28), #101(4), #103(11), #105(22), #107(17), #109(5)]
▼	Hypertext Transfer Protocol
▶	HTTP/1.1 200 OK\r\n
▶	Last-Modified: 2016-10-20 13:13:30\r\n
▶	[HTTP response 1/1]
▶	[Time since request: 0.00281526 seconds]
▶	[Request in frame: 87]
▼	Data (1155 bytes)
▶	Data: 000001000100101000000100200068040000160000002800...
▶	[Length: 1155]

0030	33 38 0a 00 00 01 00 01 00 10 10 00 00 01 00 20	38
0040	00 68 04 00 00 16 00 00 00 28 00 00 00 10 00 00	.h (.
0050	00 20 00 00 00 01 00 20 00 00 00 00 00 04 00
0060	00 13 0b 00 00 13 0b 00 00 00 00 00 00 00 00
0070	00 ff 79 29 fd ff 79 29 ff ff 79 29 ff ff 79 29	. . y . y . . y . y
0080	ff ff 79 29 ff ff 79 29 ff ff 79 29 ff ff 79 29	. . y . y . . y . y
0090	ff ff 79 29 ff fe 79 29 ff f8 76 28 ff f6 75 28	. . y . y . . v (. u (
00a0	ff f8 76 28 ff fa 77 28 ff fc 78 29 ff fd 78 29	. . v (. w (. . x . . x
00b0	fe ff 79 29 ff ff 79 29 ff ff 79 29 ff ff 79 29	. . y . y . . y . y
00c0	ff ff 79 29 ff ff 79 29 ff ff 79 29 ff ff 79 29	. . y . y . . y . y
00d0	ff fe 79 29 ff f5 74 27 ff f0 72 26 ff f3 73 27	. . y . . t ' . . r & . s
00e0	ff f6 75 28 ff f9 76 28 ff fb 77 28 ff fc 78 29	. . u (. . v (. . w (. . x

Frame (60 bytes)	Reassembled TCP (1206 bytes)
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4.5 Mail Client Program

Figure 7: The email sent to andronov@bu.edu via the mail client

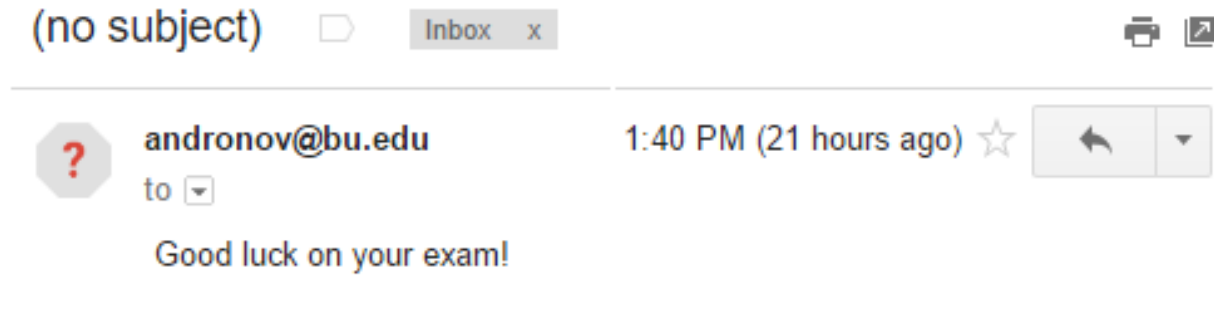


Figure 8: The commandline output when an unknown address is used

```
Terminal
File Edit View Search Terminal Help
bash-4.1$ python mail_client.py
220 relay61.bu.edu ESMTP Sendmail 8.14.3/8.14.3; Thu, 20 Oct 2016 13:42:38 -0400
250 relay61.bu.edu Hello signals42.bu.edu [128.197.52.142], pleased to meet you
250 2.1.0 <andronov@bu.edu>... Sender ok
550 5.1.1 <abcdefg@bu.edu>... Addressee unknown, see http://www.bu.edu/search/
The addressee is unknown
bash-4.1$
```